



Optimizing the 57-64 GHz Band for Broadband Deployment

June 30, 2005

Gregg Levin
Sr. VP, Product Operations
BridgeWave Communications
408.567.6999
GreggL@bridgewave.com

Importance of 60 GHz products

- **Lowest cost wireless option providing:**
 - **Multi-gigabit capacity**
 - **License-free operation**
 - **Strong interference immunity**
 - **500+ meter link distances**
- **Growth path for 10-100 Mbps 5 GHz wireless users**
 - **Small/medium enterprises**
 - **Competitive service providers**
 - **WISPs**

The WCA Proposal

- **Eliminate anomalies in the FCC's rules that effectively force license-exempt 60 GHz P-P links to operate well below the 27 dBm power limit in Section 15.255(e)**
- **Confirm that “outdoor link” exemption from Tx ID Requirement (Section 15.255(i)) also applies to antennas located indoors but directed outside a window (“window links”)**

Specifics of Proposal

- 1. Provide EIRP-based alternative to existing in-band power density rule – 15.255(b)(1)**
 - Limit average EIRP to:
82dBm - 2dB per dB antenna gain below 51dBi
 - Vendors may choose to meet current PD rule or new EIRP rule
- 2. Explicitly exempt window links from transmitter ID requirement – 15.255(i)**
- 3. No changes to:**
 - Peak power limit – 15.255(e)
 - Out-of-band emission limits – 15.255(c)



Impact of WCA's EIRP Rule on Tx Power

<u>Antenna</u>	<u>Today</u>	<u>Proposed</u>
Omni (0dBi)	27dBm*	27dBm*
12" (42dBi)	< 10dBm	22dBm
24" (48dBi)	< 15dBm	27dBm

* Using existing PD rule

Status of Petition

- **Both vendors and end-users have supported WCA's Petition**
- **Opposing comments by Agilent and SiBeam**
 - **No specifics on the nature of the “mobile” systems cited as concerns**
 - **No specifics on how petition might impact “mobile” systems**
 - **Technically inaccurate, highly generalized claims of interference**

FAQs



How much will WCA's proposal increase the FCC's 60GHz peak power limit?

None – it would remain 27dBm.

How much additional power could a high-gain antenna P-P link use under WCA's proposal?

Up to 13dB increase (20X), subject to the peak power limit of 27 dBm.

FAQs



How much would WCA's proposal increase the FCC's current EIRP limits for the 60 GHz band?

There are currently no EIRP limits for 60 GHz products – stated or implied. Very high-gain antennas can use full 27dBm today. Only under the proposed rules would EIRP be capped.

Don't higher gain antennas create higher power densities?

No. As antenna gain increases, the gain is only realized at longer distances, where it is negated by free space power loss. Antenna gain figures do not apply in the near field and transition zone.

FAQs



How would WCA's proposal affect 60 GHz mobile devices?

- No 60 GHz mobile systems exist or have been specified, making this hard to answer definitively.
- P-P links, in principle, create no more interference than other mobile systems could create.
- 7 GHz of spectrum at 57-64 GHz makes band-sharing easy – existing P-P links transmit in less than one-third of the band. Similar sharing is already common and successful at 2.4 GHz and 5.8 GHz.

Will WCA's proposal increase frequency congestion outdoors?

No, due to narrow beamwidths and oxygen absorption.

Will increased window link power put mobile systems at a higher risk of interference?

- Higher power window links would result in less reflected indoor energy than can be produced by indoor (non-window) P-P links operating under existing rules.*
- No widespread harm has been reported due to reflection issues at 2.4 or 5.8 GHz.
- Reflections are easily mitigated by link placement and/or use of RF absorbers – 60GHz signals are easy to attenuate.

* Based on 14dB reflective loss per Agilent filing

FAQs



Why use EIRP – can't we just stick with a power density rule?

- An EIRP rule is not strictly required, however...
- A 3-meter PD rule is inherently flawed when the near field extends beyond 3 meters.
- The Part 15 recommended “far field” measurement procedure and analysis grossly overstates P-P link 3-meter PD.
- A “maximum PD” rule (like the MPE safety rule) would be a reasonable alternative (1mW/cm² at aperture).

Can't users just use the E-Band (70/80/90 GHz) to achieve more link distance?

- **E-Band link prices are too high for smaller operators and enterprise users.**
 - **Manufacturing costs are thousands of dollars higher → prices of up to 4X 60GHz links**
 - **Costs will remain higher due to much lower degree of integration and stricter antenna standards**
 - **Mobile 60 GHz technology advances will create a permanent cost advantage over E-Band technologies.**
- **E-band's coordination process creates additional costs that smaller operators and enterprise users do not have at 60 GHz.**

Summary

- **A cold irony: the only 60 GHz links facing a “power penalty” are also the only 60 GHz links that are actually providing value to the public.**
- **Applications can share the 60 GHz band just as they currently share the 2.4 and 5.8 GHz bands.**
- **The WCA remains open to discussing further rule modifications to eliminate any legitimate interference concerns.**
- **Given the substantial support for WCA’s proposal, consumers would be best served by issuance of an NPRM on WCA’s Petition and a request for public comment thereon.**



Supporting Materials



Power limits for 60 GHz radios

Ant. diameter (in.)	4	8	12	24	48
Approx. gain¹ (dBi)	33	39	42	48	54
MPE-based power limit² (dBm)	13	19	22	28	34
EIRP-based power limit³ (dBm)	13	19	22	28	28
Peak power limit⁴ (dBm)	27	27	27	27	27

¹ Gain based on typical 50% efficient antenna using parabolic reflector

² Average power limit in order to meet Section 1.1310 general population MPE rule (1mW/cm²) using OET Bulletin 65 formula for maximum power density at antenna surface (4*P/A)

³ Average power limit based on meeting proposed average EIRP limit

⁴ Peak power limit from Section 15.255(e)

Proposed rule text changes

1. Replace 15.255(b)(1) with the following text:

(1) For products other than fixed field disturbance sensors, at least one of the following limits must be met:

(i) The average power density of any emission, measured during the transmit interval, shall not exceed 9 $\mu\text{W}/\text{cm}^2$, as measured 3 meters from the radiating structure, and the peak power density of any emission shall not exceed 18 $\mu\text{W}/\text{cm}^2$, as measured 3 meters from the radiating structure.

(ii) The average EIRP of any transmitter, measured during the transmit interval, shall be limited to the value of 82 dBm reduced by a factor of 2 dB for every dB that the transmit antenna far field gain is less than 51 dBi.

2. Insert words into the first sentence of 15.255(i) as follows:

(i) For all transmissions that emanate from inside a building, except for point-to-point transmissions that are directed outside through a window, within any one second interval of signal transmission, ...